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Leucotomy in England and Wales 1942—1954

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PREFACE

The treatment of certain forms of mental illness by surgical operation on the brain was introduced by Moniz in 1935. Since then some 12,000 such operations had been performed in the psychiatric hospitals in England and Wales up to the end of 1954.

It was thought that an enquiry designed to ascertain how such patients fared after operation might afford useful indications as to the kind of mental disorder amenable to surgical treatment and the kind of result which might be expected to follow it. A controlled trial was not practicable, having regard to the nature of the treatment and the range of the enquiry.

Accordingly, an enquiry was instituted on those patients who underwent a single leucotomy operation during the years 1942–1954. Included in the survey were 10,365 patients and the results are discussed in the following pages.

The results cannot afford a measure of the value of leucotomy, nor are they intended to be used as a basis of comparison with other methods of treatment particularly by the new drugs now available. They do, however, convey a general idea of what has happened to those patients suffering from different forms of mental derangement who had a leucotomy operation in the period covered by the survey.

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A REVIEW OF LEUCOTOMY IN ENGLAND AND WALES

INTRODUCTION

The wish to discover a connection between the manifestations of mental disorder and the structure and function of the brain goes back to the earliest times but has seldom been realised. Certainly the relation between some cerebral tumours and disturbances of behaviour is well established as is the efficacy of surgery for their relief. The pathological changes produced by degenerative conditions, dietary deficiencies, alcohol, and micro-organisms such as the spirochaete and the trypanosome can now be observed and correlated with the disturbances they cause. And once the cause and pathology are known, the effects of treatment can be objectively measured. But the most common forms of mental illness have no known pathology nor can their connection with the brain be reliably demonstrated. The treatment of such conditions is necessarily empirical and assessment of its effects must take account of the many other factors that may have influenced the results. Such factors include the tendency of so many mental illnesses to spontaneous remission; the effects of previous treatments on the response to the one in question, and the wide variability between hospitals in the extent and quality of after-care.

The results of the treatment of mental disorder are never easy to assess because adjustment to a disability is often as important as the relief of symptoms. Psychosurgery, or leucotomy as it is commonly termed in this country, introduces a further complication in that the changes in personality that have been known to follow it may impair the patient's ability for social adjustment and the operation may be a failure even though the distressing symptoms for which it was performed are relieved. Leucotomy has attracted more public interest and diverse comment than any other form of psychiatric treatment because, while offering the hope of almost miraculous recovery from some of the most intractable disorders, its effects, which are irreversible, have been both variable and unpredictable. Dramatic results that are not open to objective evaluation are apt to give rise to extreme opinions based on observations of the best or the worst and one of the main reasons for this survey was to obtain a general picture of the results of leucotomy against which these extreme effects could be seen in perspective.

These results cannot, of course, afford a measure of the absolute value of leucotomy nor can they be used as the basis for comparison with other forms of treatment; for these purposes a controlled experiment would be required.

The criteria on which patients were selected for leucotomy have varied with the passage of time as has also the choice of operative technique. In the early years the full standard cut was used almost exclusively but, because of the risks of personality change, it was reserved mainly for those who had failed to respond to any other form of treatment and for whom the chances of spontaneous remission seemed remote. The introduction of less drastic techniques widened the field to include patients with specific symptoms, such as tension and depression, which were known to respond to operation even though they were of relatively recent origin. There were indeed grounds for believing that the best results could be expected in patients whose illness had lasted for not more than two years and who had relapsed after a good response to electro-convulsive treatment.

THE METHOD OF ENQUIRY

The enquiry was designed to obtain information about those patients who underwent a single leucotomy operation in the years 1942 to 1954. From a preliminary enquiry, it was estimated that some 12,000 leucotomy operations had been performed in the psychiatric hospitals of England and Wales between the time the treatment was first introduced and the end of 1954. The main objectives of the survey were twofold; on the one hand to provide a descriptive account of the numbers and types of patients who had been treated by leucotomy in England and Wales in that period and in very general terms what had happened to them; and on the other, to provide internal comparisons between the post-operative condition of different classes of patients, for example, patients of different ages and sex and with different kinds of mental illness.

In planning the survey it was recognised that the information hospitals could reasonably be expected to supply would be limited to facts and observations that would normally be recorded in the case notes of the patients concerned. In addition to this basic information hospitals were asked to supply an up-to-date clinical grading of patients who were in hospital at the time of the survey and of those discharged patients who had been examined within six months prior to completing the questionnaire. Very few hospitals were able to arrange a special follow-up for the purpose of the survey and a comparatively large group of patients who had left hospital were not graded.

In collaboration with the medical staff of a number of hospitals an individual patient questionnaire was prepared. Questionnaires were sent out in May 1956 and by the time the survey was closed in December 1957 110 hospitals and other institutions concerned with the treatment of the metally sick had submitted information. The co-operation of hospital staffs, particularly during a period of great activity in the mental health service, is warmly acknowledged.

THE RESPONSE

Included in the survey were 10,365 patients each of whom had but one leucotomy operation in the period 1942 to 1954. Excluded from the survey were 462 patients reported by the participating hospitals as having had more than one such operation and 300 patients for whom the questionnaires were incomplete or inconsistent.

Some patients were undoubtedly missed by the survey, but it is difficult to estimate how many. Some indication of the completeness of the response can, however, be got by comparing the number of survey questionnaires with the number of leucotomy operations reported to the Board of Control for the years 1948 to 1952 by hospitals admitting voluntary, temporary and certified patients and mental defectives under the Lunacy and Mental Treatment and Mental Deficiency Acts. The total number of leucotomy operations in that period reported to the Board of Control was 7,225 compared with 5,775 survey questionnaires received relating to single operations in the same period. The survey figures thus fall short of complete coverage in that period by some 300 operations a year. As has already been said, part of the difference is accounted for by the omission from the survey of patients undergoing a second operation, while another omission consists of patients treated by leucotomy for reasons unconnected with mental illness, e.g. for the relief of intractable pain or the control of behaviour in mental deficiency. An unknown number of patients, probably neurotics, and for the most part operated on in general hospitals were also lost to the survey. Apart from this latter group for which the results of leucotomy might be better than the average for mental hospitals, there is no reason for believing that the survey population is biased by any of the excluded groups.

PRESENTATION OF THE RESULTS

The findings from the survey are presented below. Additional statistical tables and notes on method are given in Appendices 1 and 2. The report itself falls broadly into two parts, the first describing the patients, the nature of their illness, their operations, and their stay in hospital, and the second the clinical outcome of the operations.

THE PATIENTS AND THEIR OPERATIONS

THE NUMBER OF OPERATIONS

Table I shows the number of leucotomy operations included in the survey (10,365) analysed by year of operation and sex of patient.

Table I. Total patients: analysis by year of operation and sex

	Total	Male	Female
Total	10,365	4,027	6,338
Year of operation:—			
1942	101	26	75
1943	190	74	116
1944	276	105	171
1945	330	123	207
1946	585	219	366
1947	941	392	549
1948	1,159	485	674
1949	1,211	467	744
1950	1,155	422	733
1951	1,073	384	689
1952	1,177	469	708
1953	1,073	432	641
1954	1,094	429	665

More than half the operations included in the survey were done in the years 1950 to 1954: only about 100 operations were recorded in 1942, the number increasing steadily until 1949 when it exceeded 1,200.

THE KINDS OF ILLNESS AND OPERATION

The mainly descriptive diagnosis that the absence of a known pathology imposes on psychiatry is one of the chief stumbling blocks in the classification of mental illness. Not only do the reaction patterns of individuals change with the passage of time, but the views of psychiatrists on the names that should be attached to them are by no means constant. A patient may, for example, present neurotic symptoms when first seen and then develop a depression which lifts after a time to reveal a schizophrenic state. Which of these diagnostic labels is attached depends on when the patient is seen and by whom.

Well over 100 different diagnostic descriptions were returned in the survey. There were the usual combinations of psychoses with neurotic, organic, and constitutional features, but there were also many mixed psychotic states, for example, depression with schizophrenia and vice versa. To have attempted an analysis of all these categories was out of the question and so the number was first reduced by confining attention to that part of the diagnostic description which seemed most likely to have affected the decision to perform leucotomy. Thus "obsessional neurosis with schizoid or depressive features" was coded "neurosis," "melancholia with schizophrenia" as "affective state" and so on. In this way the diagnostic categories were reduced to 12 and subsequently, by combining categories which differed relatively little from one another and accounted for only small numbers of cases, to 5, viz. affective, schizophrenic, organic, neurotic and paranoid. The last three of these groups have been taken together in all the main analyses so that these are in terms of the three broad diagnostic classes of patient which are referred to as affective, schizophrenic and other.

Throughout this report, the term leucotomy is used in a generic sense but of course it includes a number of different types of operation. Up to 1945 only standard operations were reported but thereafter as experience grew, many modifications were evolved and some entirely new kinds appeared. The number of these new operations was so large and the proportion of patients treated by any one of them so small that separate analysis of the results was not attempted. Instead they are considered together under the heading "other operations." Table II shows the numbers of patients in the three diagnostic groups analysed by the kind of operation they underwent and their sex and age at operation.

Table II. Total patients: analysis by diagnostic group, type of operation, sex and age at operation

	Total	Diagnostic Group		
		Schizophrenic	Affective	Other
Patients: Total number	10,365	6,591	2,637	1,137
Type of operation:—				
Standard	8,769	5,850	2,079	840
Modified standard	701	310	281	110
Other	895	431	277	187
Per cent in each age group*				
Under 25 years	8	11	1	7
25–34 years	28	37	6	25
35–44 years	28	30	19	31
45–54 years	20	16	30	23
55–64 years	12	5	31	11
65 years and over	4	1	13	3
Males: Total number...	4,027	2,813	794	420
Per cent in each age group*				
Under 25 years	9	13	1	6
25–34 years	34	43	4	28
35–44 years	27	28	18	31
45–54 years	17	12	28	23
55–64 years	10	3	35	9
65 years and over	3	1	14	3
Females: Total number	6,338	3,778	1,843	717
Per cent in each age group*				
Under 25 years	6	9	1	8
25–34 years	24	32	7	23
35–44 years	28	32	19	30
45–54 years	23	19	31	23
55–64 years	14	7	29	12
65 years and over	5	1	13	4

* Age at operation.

Of the total patients, 64 per cent were schizophrenics, 25 per cent affectives and 11 per cent had other diagnoses. The standard operation represented 84 per cent of all operations, the modified standard 7 per cent and other operations 9 per cent. The standard technique was used relatively more often for schizophrenic patients; 89 per cent of these patients had the standard operation compared with 79 per cent of the affectives and 74 per cent of patients with other diagnoses.

Of the 10,365 leucotomy operations 4,027 were done on males and 6,338 on females. The numbers are greater for females in each of the three diagnostic groups, but were proportionately greatest for patients with affective states.

Of the total operations 36 per cent were done on patients under 35 years old, 60 per cent on those aged 35–64 and 4 per cent on older patients. For schizophrenic patients the corresponding percentages were 48, 51 and 1 respectively; for affective patients 7, 80 and 13 respectively and for patients with other diagnoses 32, 65 and 3 respectively. Thus the proportion of young patients operated on was higher for the schizophrenic group than for the other groups.

No trends of any consequence could be detected over the period covered by the survey in the sex or age distribution of patients undergoing leucotomy, or in their diagnostic distribution.

It is difficult to draw conclusions from comparison of the age and sex distribution of the survey patients and of all patients in or passing through the mental hospitals during the survey period, but it would seem that a slightly greater proportion of females than of males were selected for operation and, as would be expected, relatively more patients were selected from the middle age range.

THE DURATION OF ILLNESS BEFORE OPERATION

Table III shows that in only 14 per cent of patients was leucotomy performed in less than 2 years after the onset of illness and 41 per cent had been ill for over 6 years before this treatment was adopted.

Table III. Total patients: analysis by diagnostic group and duration of illness before operation

	Total	Diagnostic Group					
		Schizophrenic		Affective		Other	
		Male	Female	Male	Female	Male	Female
Number	10,365	2,813	3,778	794	1,843	420	717
Per cent in each group by duration of illness before operation*:—							
Under 2 years ...	14	13	11	20	21	12	12
2–6 years	45	47	44	43	43	36	42
7–11 years	19	21	22	16	14	20	19
12–16 years	10	10	11	8	9	10	11
17 years and over ...	12	9	12	13	13	22	16

* Excluding cases where the duration of illness was not known.

THE WHEREABOUTS OF THE PATIENTS AT THE TIME OF REPORT

The patients included in the survey fall into three main groups; those who had left hospital and were either still living or had died; those who were still in hospital and those who had died in hospital.

Table IV shows the whereabouts of the patients in each of the three diagnostic groups at the time of the survey.

Table IV. Total patients: analysis of whereabouts of patients at the time of the survey by diagnostic group and sex

	Total	Diagnostic Group					
		Schizophrenic		Affective		Other	
		Male	Female	Male	Female	Male	Female
Number							
Total	10,365	2,813	3,778	794	1,843	420	717
Discharged (including died after discharge)	4,768	880	1,386	500	1,265	279	458
In hospital	4,710	1,731	2,133	156	401	90	199
Died in hospital ...	887	202	259	138	177	51	60
Per cent:							
Discharged (including died after discharge)	46	31	37	63	69	66	64
In hospital	45	62	56	20	22	22	28
Died in hospital ...	9	7	7	17	9	12	8

The majority of schizophrenic patients who had been treated by leucotomy were still in hospital while the reverse was the case for the affective and other diagnoses. On the other hand the proportion of deaths among schizophrenic patients was low, probably because they were a younger group. For schizophrenic and affective patients the proportion discharged was a little higher for women than for men.

THE LENGTH OF STAY IN HOSPITAL AFTER OPERATION

The survey gives limited evidence, which may nevertheless be of interest, on the length of time that patients remained in hospital after their leucotomy operations. It is limited by the complicating factor of relapse and by the fact that the information provided in the survey was on the date of last discharge. A further factor to be taken into account is that some of the survey reports were obtained only a year after the operation and it is therefore only the incidence of discharges within a year that can be estimated without bias.

Table V illustrates the considerable difference in length of stay in hospital between diagnostic groups.

Table V. Total patients and those discharged within a year of operation: analysis by diagnostic group

	Total	Diagnostic Group		
		Schizophrenic	Affective	Other
Total number having a leucotomy operation	10,365	6,591	2,637	1,137
Number who had left hospital at the time of the survey and whose last discharge was within:—				
2 months of operation* ...	629	119	304	206
4 months of operation	1,615	429	786	400
12 months of operation	3,146	1,295	1,280	571
Per cent who had left hospital at the time of the survey and whose last discharge was within:—				
2 months of operation* ...	6	2	12	18
4 months of operation	16	7	30	35
12 months of operation	30	20	49	50

* The same or next calendar month after the operation.

Comparatively few schizophrenic patients had left hospital within a year, 20 per cent being out at the end of 12 months as compared with 49 and 50 per cent respectively for affective patients and those with other diagnoses. As many as 12 per cent of the affective patients were out of hospital after 2 months and 30 per cent after 4 months; the figures are even higher for the "other" diagnoses, but very few of the schizophrenic patients were out after such short intervals. The high proportion of early discharges in the "other" diagnoses group is probably due to the numbers of neurotic patients with good prognoses that it contains.

THE METHOD OF POST-OPERATIVE CLINICAL ASSESSMENT

About three-quarters of the psychiatric hospital population show peculiarities of behaviour or social eccentricities and their chances of returning to the community depend upon the public attitude towards such deviations and upon various social and economic factors unconnected with medicine. The bare fact of leaving hospital after treatment is therefore an unreliable criterion of its success. There is no doubt that leucotomy has been frequently used to enable patients who must remain in hospital to live fuller and freer lives. It would therefore be as misleading to regard all those who had to stay in hospital after leucotomy as failures, as it would be to claim as successes all those who were subsequently able to leave.

In order to supply a measure of the patient's condition after operation, independent of whether he was in or out of hospital at the time of the survey, two rating scales were provided. They are as follows:

For patients still in hospital

H 1. Improvement not amounting to social recovery but sufficient to enable patient to live outside hospital if home and work conditions were suitable.

H 2. Better social adjustment but with residual symptoms of the original illness, e.g. delusions or hallucinations, which are no longer disabling in a sheltered environment.

H 3. Unable to manage outside hospital because of persistent symptoms of the original illness, but more amenable and able to enjoy greater freedom in a restricted environment.

H 4. Symptoms of the original illness unchanged following operation or worse because of the progress of the disease.

H 5. Original symptoms unchanged or worse, with the addition of serious changes attributable to operation.

For patients followed up after discharge from hospital

D 1. Freedom from symptoms. Return to former or equivalent work and social adjustment.

D 2. Return to former social environment and work in spite of minor symptoms of the original illness or sequelae of operation.

D 3. Improvement not amounting to social recovery but sufficient to enable patient to live outside hospital so long as financial support and some supervision is provided.

D 4. Showing well marked symptoms of the original illness or attributable to operation but manageable at home because of their mild quality.

D 5. Completely dependent and needing constant care and supervision. Would be in hospital but for the devotion and/or financial resources of relatives.

It will be noticed that the first point on the hospital scale corresponds with the third on the scale for those who had left. Hospital patients in this first grade could have been living outside if social conditions had been favourable. Similarly patients in the two lowest grades of those who had left hospital would have required in-patient care if their needs had not been met by society and the fourth and fifth points on the scale for those who had left hospital correspond with the second and third points respectively on the hospital scale.

THE INTERPRETATION OF THE CLINICAL DATA

In considering the findings of the survey, two aspects of interpretation of the clinical data need to be borne in mind, the effects of the passage of time on the clinical grading and the use of forms of treatment other than leucotomy during the period of the survey.

The clinical gradings reported in the survey refer to the condition of the patient at the time the survey record was completed, or in the case of discharged patients, within 6 months of this date. The questionnaires were sent out to the hospitals in May 1956 and the survey was closed in December 1957 so that the first and last assessment could have been separated by a period of two years. Moreover the survey covered operations performed over a period of thirteen years (1942 to 1954) and there is, therefore, a wide variation in the time that had elapsed between the operation and the survey report.

Since it is possible that the condition of a patient may have changed considerably over so long a period, whether or not such changes were due solely to leucotomy, the clinical gradings of patients assessed after different intervals of time since operation were compared. The purpose of this analysis was to examine whether it was necessary to look at the results separately for patients in similar "interval groups". A note on this analysis is given at A of Appendix 2 and shows that the differences in grading for the different interval groups are small enough to allow this factor reasonably to be ignored in presenting the survey findings.

In the references that have been made to changes in the condition of the patient after leucotomy, care has been taken to avoid any direct implication that leucotomy only was responsible for the change. It would be wrong to draw any such inference, and it is quite impossible, from the information obtained, to give due weight to the many other factors that must have affected the condition and welfare of the patient, including his likelihood of discharge from hospital. This survey must in fact be looked at against the background of the mental health service as a whole and of the social situation in the community, for although important changes were taking place at the time the survey was being planned, their effects did not appear until some years later. In fact it was not until the end of 1955 that, in spite of an ever increasing admission rate, a fall in the number of patients in the mental hospitals was first detected. This turn in the tide reflected many different influences, of which the most important were early and effective treatment both in hospital and in the community, success in the rehabilitation of long stay patients, an improved public understanding of the needs of the mentally disordered and an economy that could offer them employment. Then too, by the end of 1955, the use of the tranquillising drugs, which were introduced early in the previous year, had become widespread. It is only reasonable to expect that leucotomy patients were affected by these changes no less than the rest of the hospital population and Table VI, which has been derived from survey data for the operations performed in each separate year covered by the survey, does in fact show there to be, among those operated on in the last two or three years of the survey, a relatively large number of early discharges from hospital.

Table VI. Estimated number of discharges per 1,000 *operations a year: analysis by period of discharge and interval between operation and discharge*

	Period of discharge*						
	1949–50	1950–51	1951–52	1952–53	1953–54	1954–55	1955–56
Interval between operation and discharge:—							
Under 1 year ...	306	302	328	314	353	359	..
1 year but under 2...	51	50	60	47	57	70	77†
2 years ,, ,, 3...	15	23	21	22	27	31	46
3 ,, ,, ,, 4...	22	10	13	12	18	20	41
4 ,, ,, ,, 5...	18	7	7	13	12	16	29
5 ,, ,, ,, 6...	7	21	9	11	13	13	23
6 ,, ,, ,, 7...	11	14	6	3	7	15	13
7 ,, ,, ,, 8...	10	11	11	9	9	9	16
8 ,, ,, ,, 9...	..	10	16	4	9	9	19
9 ,, ,, ,, 10...	..	..	10	5	—	3	10
10 ,, and over ...	..	..	..	49	42	22	36
Total 1 and under 8 years	134	136	127	117	143	174	245
Total 1 and under 10 years	..	..	153	126	152	186	274

* Period 1949–1950 means a period centred on 1.1.50.

The sign ".." indicates "not available" and the sign "—" indicates "nil".

† Excluding a few cases operated on in 1955 which could have been discharged in 1956 within the 1–2 year interval.

The numbers of discharges relative to numbers of operations were considerably higher in 1955–56 than in previous calendar periods, and the excess was spread over all intervals between operation and discharge. The increase was evident, to a lesser extent, in 1954–55 and 1953–54. Similar results are obtained for the schizophrenic group of patients taken by itself. These differences may well be due to the combination of factors mentioned above.

THE INCLUSION OF DISCHARGED PATIENTS WITH NO CLINICAL GRADING

Psychiatric hospitals commonly keep in touch with their former patients through out-patients' clinics or by means of visits from social workers. How long this after-care is continued depends on the progress made by the patient but the pressure of out-patient work is very great and it is safe to assume that patients are not encouraged to go on attending once they can stand on their own feet. Hospitals taking part in the survey were asked to record the condition of their ex-patients who had had a leucotomy operation and these clinical gradings were included in the analysis if the patient to whom they referred had been examined within 6 months of completing the survey card. Many hospitals had followed up some of their leucotomy patients but only a few had attempted to trace them all. Of the 4,768 patients discharged from hospital at the time of the survey, follow-up reports were returned for 1,700, that is just over one third. Table VII shows the return for the different diagnostic groups.

Table VII. Number of followed-up and not followed-up discharges: analysis by diagnostic group and sex*

	Total	Followed-up cases	Not followed-up cases
All diagnoses:			
Total	4,768	1,700	3,068
Males	1,659	532	1,127
Females	3,109	1,168	1,941
Schizophrenic:			
Total	2,266	765	1,501
Males	880	278	602
Females	1,386	487	899
Affective:			
Total	1,765	707	1,058
Males	500	186	314
Females	1,265	521	744
Other:			
Total	737	228	509
Males	279	68	211
Females	458	160	298

* Including all deaths after discharge.

To get a picture of the clinical grading of all the patients in the survey, it was of course necessary to include those discharged patients who had not been followed up. Clearly discharged patients would on the whole have better assessments than those in hospital, and to confine the results to those discharged patients for whom gradings were available would have been to underestimate the improvements in condition which followed leucotomy. It was decided that the most reasonable estimates of the whole "population" of 10,365 patients in the survey would be obtained by making the general assumption that the discharged patients who were not graded were similar to those for whom gradings were obtained. (See B of Appendix 2.)

It seems reasonable to assume that the group of discharged patients who had kept in touch with the hospital and were thus available for clinical grading had, on the whole, responded less favourably to leucotomy than those who did not seek further attention. By using the gradings of this followed-up group as the basis for estimating the condition of all discharged patients, it is thus likely that the proportion of those in the less favourable grades has been over-represented.

The number of deaths among discharged patients is also known only for those who had been followed-up, but this defect is not of much importance because it was appropriate to exclude from the analysis of clinical findings all deaths not attributed to leucotomy. Virtually all the known deaths among discharged patients came into this category and it is reasonable to assume that the same applied to those who were not followed-up.

THE CLINICAL FINDINGS

CLINICAL CONDITION

The distribution of the patients in the survey according to their clinical condition is given in Table VIII, where the grading scales of patients in hospital and patients discharged have been amalgamated as described in the previous section, deaths not attributed to leucotomy have been excluded and discharged patients who were not followed-up have been included on an estimated basis as described at B of Appendix 2.

Table VIII. Total patients: analysis by clinical condition at time of survey report, diagnostic group and sex*

	Total			Diagnostic Group					
				Schizophrenic		Affective		Other	
	Patients	Male	Female	Male	Female	Male	Female	Male	Female
Number*	9,284	3,577	5,707	2,627	3,519	582	1,557	368	631
Per cent in each clinical category at time of survey report†:									
Total recovery (D1)	13	10	15	6	8	24	29	16	19
Social recovery (D2)	16	14	17	11	12	23	23	25	25
Greatly improved (D3 + H1) ..	12	12	12	11	12	13	12	19	14
Family invalid and Social improvement (D4 + H2)	13	13	13	13	15	12	10	14	15
Family burden and Social defect (D5 + H3) ..	15	17	15	19	18	11	8	8	10
No change (H4)..	25	28	23	34	31	9	11	8	12
Worse (H5) ..	2	2	2	2	2	1	2	3	1
Death due wholly or partly to operation ..	4	4	3	4	2	7	5	7	4

* The figures in this table are extracts from Table 8 of Appendix I. Patients whose death was not attributed to the operation are excluded; estimates by clinical category for not followed-up discharge cases are included.

† The bracketed codes (D1) (D2) (D3 + H1) etc, given in this table and in the following tables IX and X refer to the rating scales which are described in full on pages 8 and 9 above.

It will be seen that 36 per cent of men and 44 per cent of women were reported as at least greatly improved after the operation; and at the other end of the scale 4 per cent of men and 3 per cent of women died with death being wholly or partly attributed to leucotomy.

As was to be expected from the results of other investigations, improvement was most marked in the affective group and least in the schizophrenic. The proportion of patients reported to be entirely free from symptoms was higher for women than for men in each of the diagnostic groups (15 per cent as compared with 10 per cent overall).

The numbers are large enough for differences by sex and age to be discerned among the schizophrenic patients and Table IX gives the figures.

Table IX. Schizophrenic patients: analysis by clinical condition at time of survey report, sex and age at operation*

	Total	Age at operation (years)				
		Under 25	25–34	35–44	45–54	55 and over
Males						
Number*	2,627	328	1,147	764	327	61
Per cent in each clinical category at time of survey report†:						
Total recovery (D1)	6	5	7	6	7	—
Social recovery (D2)	11	9	11	12	10	8
Greatly improved (D3 + H1) ..	11	11	10	12	10	10
Family invalid and Social improvement (D4 + H2) ..	13	12	15	12	13	12
Family burden and Social defect (D5 + H3)	19	16	19	19	21	18
No change (H4)..	34	42	32	35	33	31
Worse (H5)	2	3	3	1	1	—
Death due wholly or partly to operation	4	2	3	3	5	21
Females						
Number*	3,519	310	1,169	1,117	665	258
Per cent in each clinical category at time of survey report†:						
Total recovery (D1)	8	13	9	5	8	10
Social recovery (D2)	12	12	13	15	7	8
Greatly improved (D3 + H1) ..	12	12	13	11	9	10
Family invalid and Social improvement (D4 + H2) ..	15	15	15	15	17	10
Family burden and Social defect (D5 + H3)	18	18	17	20	20	19
No change (H4)..	31	28	29	31	34	35
Worse (H5)	2	1	2	2	2	3
Death due wholly or partly to operation	2	1	2	1	3	5

* See footnote * to Table VIII.

† See footnote † to Table VIII.

It would appear that for women patients the chances of improvement are a little greater for patients operated on at the younger ages; these differences are not very large but they cannot be accounted for in terms of chance variations due to sampling. For men patients the opposite is the case, although the differences between male age-groups are not as significant. There is, however, a real difference between the age-effects of men and women patients. No sex-age differences can be detected for affective patients or those with other conditions.

Differences by duration of illness prior to the leucotomy operation are summarised for the schizophrenic group in Table X.

Table X. Schizophrenic patients: analysis by clinical condition at time of survey report and duration of illness before operation*

	Total	Duration of illness before operation (years)				
		Under 2	2–6	7–11	12–16	17 and over
Number*	6,146‡	716	2,651	1,256	631	616
Per cent in each clinical category at time of survey report†:						
Total recovery (D1)	7	14	8	6	6	3
Social recovery (D2)	12	13	14	10	8	4
Greatly improved (D3 + H1)	11	17	12	9	9	8
Family invalid and Social improvement (D4 + H2) ..	14	10	14	13	15	18
Family burden and Social defect (D5 + H3)	19	17	17	22	20	25
No change (H4)	32	25	30	35	38	37
Worse (H5)	2	2	2	2	1	1
Death due wholly or partly to operation	3	2	3	3	3	4

* See footnote * to Table VIII.

† See footnote † to Table VIII.

‡ Including 276 cases for which duration was not known.

There is a distinct gradient to be seen in this table, the proportions of successful results being appreciably higher for patients who had been ill for shorter periods of time. However, this cannot be said with any confidence for the other diagnostic groups.

The combined effects of age and duration of illness on chances of improvement after operation were too small to warrant reporting the effects of either factor separately.

RELAPSE

One of the indications for leucotomy has been to prevent the relapses that are liable to occur after other forms of treatment; an attempt was therefore made to determine the incidence of relapse after leucotomy.

In seeking information about relapse it was necessary to take account of patients who had relapsed while in hospital and were still there; of those who had left hospital after leucotomy but had been re-admitted following a relapse; and of those who, although they were out of hospital at the time of the survey, had previously been re-admitted in a relapse. The figures given in Table XI below distinguish all these categories.

This was, however, one of the questions that hospitals evidently found difficulty in answering and in fact it was left unanswered in a substantial number of cases. In analysing the results it was assumed that no reply to this question meant that no relapse had occurred but this interpretation may not be valid. Nevertheless the figures reported do at least indicate the minimum incidence of relapse.

Table XI. Total patients: analysis by incidence of relapse, diagnostic group and age at operation*

	Total	Age at operation (years)				
		Under 25	25–34	35–44	45–54	55 and over
All diagnoses						
Number*	9,284	729	2,722	2,645	1,911	1,277
Per cent reported as:						
Having relapsed, still alive	21	38	26	21	17	15
Not having relapsed, still alive	75	60	72	77	79	77
Dead	4	2	2	2	4	8
Schizophrenic						
Number*	6,146	638	2,316	1,881	992	319
Per cent reported as:						
Having relapsed, still alive	24	39	27	21	16	13
Not having relapsed, still alive	73	59	71	77	80	79
Dead	3	2	2	2	4	8
Affective						
Number*	2,139	18	154	451	682	834
Per cent reported as:						
Having relapsed, still alive	18	39	21	20	18	16
Not having relapsed, still alive	77	56	76	77	78	76
Dead	5	5	3	3	4	8
Other						
Number*	999	73	252	313	237	124
Per cent reported as:						
Having relapsed, still alive	22	28	25	27	19	12
Not having relapsed, still alive	73	65	71	70	75	78
Dead	5	7	4	3	6	10

* Patients whose death was not attributed to the operation are excluded; estimates by incidence of relapse for not followed-up discharge cases are included.

The overall proportion of patients reported as having relapsed was 21 per cent. It was highest (24 per cent) for schizophrenic patients but the differences between diagnostic groups are not large. Patients who had relapsed were found both among those in hospital and those discharged, and likewise patients who were not reported as having relapsed were by no means all discharged patients.

There were some considerable differences in the incidence of relapse between patients operated on at different ages. It would appear that the risk of relapse was higher for patients operated on at earlier ages: altogether 38 per cent of patients in the under 25 age-group were reported as having relapsed as compared with only 15 per cent for the 55 and over age-group. If deaths attributed wholly or partly to leucotomy are assumed to have been preceded by relapse this age-effect is still apparent, and neither is it affected by the exclusion of deaths not attributed to the operation. This greater risk of relapse among the younger patients is evident in each of the diagnostic groups.

Table XII shows the incidence of relapse according to duration of illness before operation.

Table XII. Total patients: analysis by incidence of relapse, diagnostic group and duration of illness before operation*

	Total	Duration of illness before operation (years)				
		Under 2	2–6	7–11	12–16	17 and over
All diagnoses						
Number*	9,284†	1,242	3,893	1,737	926	1,051
Per cent reported as:						
Having relapsed, still alive ..	21	24	24	21	21	18
Not having relapsed, still alive	75	72	73	76	76	77
Dead	4	4	3	3	3	5
Schizophrenic						
Number*	6,146	716	2,651	1,256	631	616
Per cent reported as:						
Having relapsed, still alive ..	24	29	27	20	18	16
Not having relapsed, still alive	73	68	71	77	79	79
Dead	3	3	2	3	3	5
Affective						
Number*	2,139	421	872	306	195	273
Per cent reported as:						
Having relapsed, still alive ..	18	19	15	20	24	19
Not having relapsed, still alive	77	75	79	75	71	78
Dead	5	6	6	5	5	3
Other						
Number*	999	105	370	175	100	162
Per cent reported as:						
Having relapsed, still alive ..	22	7	23	34	29	23
Not having relapsed, still alive	73	89	74	62	65	67
Dead	5	4	3	4	6	10

* Patients whose death was not attributed to the operation are excluded; estimates by incidence of relapse for not followed-up discharge cases are included.

† Including 435 cases for which duration of illness was not known.

For the schizophrenic group the incidence of relapse was appreciably higher for those whose illness had been of shorter duration. Steadily changing differences by duration are not clearly evident for the other diagnostic groups, but the rarity of relapse in the "other" diagnostic group for patients who had been ill for under two years may have significance.

EPILEPSY

Any damage to the brain whether produced by drugs, infections, accidents or surgery may be followed by epileptic attacks; and epilepsy is one of the recognised hazards of leucotomy. The epileptic fits that may follow leucotomy are of two kinds: transient fits that occur within the first few weeks after operation and do not recur, and those that either persist from the time of the operation for periods of years or first occur some time after the operation but tend to persist. These two types of epilepsy are probably due to different pathological causes and their prognostic significance is also different. Transient attacks, probably due to cerebral oedema, are relatively common and are of little consequence but frequent fits in the later stages of convalescence may be due to the formation of scar tissue and are liable to become a permanent disability. In this survey information about both these main types of epilepsy was sought, and a distinction was also made between patients who had suffered from epileptic fits prior to the leucotomy operation and those who had not.

As with the question on relapse, the section of the questionnaire dealing with transient epilepsy was in many cases left unanswered probably because it often involved a long search through old case notes. This does not apply to epilepsy that had persisted up to the time of the survey. The information on this persistent epilepsy is regarded as reliable and is presented in Table XIII.

Table XIII. Total patients: analysis by incidence of persistent epilepsy, diagnosis, type of operation and sex

	Patients having a leucotomy operation	
	Total	With epilepsy (not present before operation) persisting at the time of the survey or at death
Total	10,365	135
Type of operation:		
Standard	8,769	122
Modified standard	701	8
Rostral	491	1
Other..	404	4
Diagnosis:		
Schizophrenic: male ..	2,813	44
" female ..	3,778	48
Affective: male ..	794	14
" female ..	1,843	17
Other: male ..	420	6
" female ..	717	6

The overall proportion of patients with persistent epilepsy is 1·3 per cent. The figures in Table XIII give no indication of any differences by type of operation, diagnosis or sex.

SEQUELAE OF OPERATION

One of the hazards of leucotomy is the possibility that it may produce changes in personality or behaviour which are quite distinct from the effects for which the operation was performed and quite distinct from what might be expected from the advance of the disease process which was the reason for the operation. By their nature such changes are difficult to recognise and assess, especially in a hospital setting and by people who are usually unfamiliar with the previous personality of the patient.

In so far as such sequelae represent undesirable changes they may well be considered an unfavourable result of leucotomy and rightly have been the cause of adverse criticism which has been levelled against leucotomy operations.

In spite of the difficulties of assessment an attempt was made in the survey to determine the extent of unfavourable symptoms of this kind. The following extract from the notes on the completion of the questionnaire describes the grading scale used for sequelae:

"This scale refers to symptoms which have appeared since operation, are considered to be attributed to the operation, and persist at the time of this survey. It is intended for symptoms which are unfavourable to the patient's social adjustment and should show the degree of disablement attributable to the operation as distinct from that due to the original illness.

Such symptoms will be mainly mental and indicative of interference with the frontal lobes but, since it will not be possible to make use of descriptions of the symptoms themselves, the following scale has been designed to record their intensity:—

1. No appreciable unfavourable symptoms.
2. Symptoms present but mild in quality or slight in degree.
3. Symptoms of sufficient severity to prevent the patient's discharge even after relief of the original illness.
4. Symptoms which have led to a greater restriction of the patient's life in hospital and consequent diminution of enjoyment than might have been expected as a result of the illness, if the operation had not been performed.
5. Symptoms of quality and degree necessitating special measures for the control of the patient."

It will be noted that this scale limits the definition of the more seriously unfavourable symptoms to those more easily assessable aspects of a patient's condition which affect his ability to live outside hospital or which necessitate special measures concerning his life as a hospital patient. As with the question about epilepsy this question was left unanswered in a large number of cases, but the comparatively objective nature of the assessment of the more severe effects gives some grounds for thinking that these have been adequately reported and that the failure to reply was for cases with no or only slightly unfavourable sequelae. Table XIV is therefore presented to provide an indication of the incidence of the more severe effects.

Table XIV. Total patients: analysis by incidence of severe sequelae, type of operation and age at operation

	Patients having a leucotomy operation		
		With severe sequelae*	
	Total	Number	Per cent of total having a leucotomy
Total	10,365	319	3·1
Standard type operations: Total	8,769	278	3·2
Age at operation (years):			
Under 25	677	18	2·7
25–34	2,472	66	2·7
35–44	2,460	65	2·6
45–54	1,765	57	3·2
55–64	1,067	53	5·0
65 and over	328	19	5·8
Modified standard type operations: Total	701	16	2·3
Other type operations: Total	895	25	2·8

* Hospital patients with sequelae severe enough to prevent their discharge from hospital, and patients who had severe sequelae who had died.

Overall the proportion of patients experiencing severe sequelae as defined was 3·1 per cent. The numbers of patients in which non-standard type operations were used are too small for this table to show any significant differences in the incidence of severe sequelae by type of operation, but it would seem that the younger patients were less seriously affected than those over age 55.

DISCUSSION

Between 1948 and 1955, when this survey was planned, over 1,000 patients yearly had leucotomy operations in the mental hospitals of England and Wales; by 1959 the number had fallen to 400. The results reported here throw little light on the reasons for the decline in popularity of this form of treatment.

At the time of the survey the number of patients in the mental hospitals had reached a peak and it had become evident that for those who had been ill for two years and over the chances of improvement to the extent of being able to leave hospital were remote.

Up to 1955 leucotomy was for most patients the last therapeutic resort beyond which lay a future with almost no hope of recovery and with considerable suffering. The results of the survey should be looked at against this contemporary background.

It was not possible to undertake a controlled trial in which the exposure of the individual patient to the potential benefits and hazards of this surgical procedure would be left to random selection. The results of this descriptive survey can, therefore, only be assessed against the expected clinical course in the absence of surgery.

The figures show that 41 per cent of the survey patients had been ill for 6 years and over. Also 41 per cent are reported as having at least greatly improved following their operation. It has been said that the best results from leucotomy may be expected if the operation is performed early in the course of the illness. But the survey shows that there was greater improvement than would have been expected without surgery, even when used as a last resort, in a considerable proportion of patients in whom the prognosis would, at the time, have been regarded as most unfavourable.

The other side of the picture shows that 25 per cent of these patients were unchanged, 2 per cent were worse, and 4 per cent were dead with death attributed wholly or partly to operation. If these figures told the whole story there is little doubt that leucotomy would still be widely used. That it is not so is almost certainly due to the appreciation that it carries with it a peculiar and unpredictable risk the effects of which may be irreversible, and that, since 1955, drug treatments have provided a safer means of obtaining comparable results. There is no doubt that many of the distressing symptoms of mental illness can be relieved by leucotomy and the patient is thereby set free to come to terms with life. But it is also beyond question that in some cases relief from suffering has been bought at the price of accepting a level of existence qualitatively different from and usually below that which the patient had enjoyed before the onset of illness. This kind of bargain has often to be struck in medical practice, for example the decision to amputate or establish a permanent colostomy is taken with the full understanding that it will impose on the patient a less agreeable and usually more restricted life; but the ability to adjust still rests with the patient. Leucotomy on the other hand, while relieving distress, can impair those faculties that make it possible for the patient to adjust to life and benefit from his new freedom.

Although, because they are so difficult to assess objectively, the survey throws little light on the incidence of these undesirable side effects, it is likely that they, more than any other factor, account for the falling off in the use of leucotomy. It is, of course, claimed that advances in surgical technique have reduced the likelihood of these post-operative sequelae, but the number of patients in the survey who had been treated by the less radical methods was too small to enable worthwhile comparison to be made between the results of these and the older techniques.

SUMMARY

This survey was concerned with the 10,365 persons who had a single leucotomy operation for the treatment of mental illness between 1942 and the end of 1954. Its aim was to record in general terms what had happened to these patients. The tracing and grading of patients lasted from May 1956 to December 1957, and the report described their characteristics and condition at this period of time.

The proportions of patients in the main diagnostic groups were: schizophrenics 64 per cent, affectives 25 per cent, other diagnoses 11 per cent.

Women exceeded men in the proportion of 3 to 2 and there was a preponderance of women in each of the diagnostic groups. Of all patients, 36 per cent were under the age of 35 years, 60 per cent were aged between 35 and 64, and 4 per cent were 65 or over at the time of operation.

In the schizophrenic group the proportion of men aged under 35 years was 56 per cent compared with 41 per cent of women. The corresponding figures for the affective group were 5 per cent for men and 8 per cent for women.

In only 14 per cent of patients was the operation performed within two years of the onset of illness; 41 per cent of patients had been ill for more than six years before leucotomy was decided upon.

Throughout the years covered by the survey the standard type of operation was most commonly used and 84 per cent of patients had this type of leucotomy; modifications of the standard technique were used on 7 per cent, and 9 per cent had a variety of the more recent techniques.

At the time of the survey 46 per cent of the patients had been discharged from hospital, 45 per cent were in hospital and 9 per cent had died in hospital.

The length of stay in hospital after operation and before discharge varied considerably between the diagnostic groups: within the first year of operation 49 per cent of affectives and 50 per cent of those with other diagnoses had left hospital as compared with 20 per cent of schizophrenics. A higher proportion of patients left hospital in the later years covered by the survey and this is considered to be due to a general trend unconnected with leucotomy.

Of all the patients alive at the time of the survey, clinical gradings were obtained for 6,410 of whom 74 per cent were still in hospital and 26 per cent had been followed-up after discharge. By amalgamating the grading scales for those in hospital and those discharged, including estimates for not followed-up cases, it was found that 36 per cent of men and 44 per cent of women were said to have been at least greatly improved after operation; 2 per cent of both men and women were worse; and 4 per cent of men and 3 per cent of women had died, their deaths being wholly or partly due to the operation.

In accordance with expectation, improvement was most marked among the affective group and least among the schizophrenics. In each diagnostic group women did slightly better than men.

Among the women schizophrenics, the younger patients did somewhat better than the older, but the reverse was true for the men. Also among the schizophrenics, those who had been ill for shorter periods showed the greater measure of improvement, but this was not apparent in the case of the affectives or those with other diagnoses.

In all, 21 per cent relapsed after operation and the relapse rate was slightly higher for schizophrenics. Relapse occurred more frequently in the younger age groups in each diagnostic category: 38 per cent of relapses were recorded for

patients under the age of 25 as compared with 15 per cent for those aged 55 and over.

Among the schizophrenics, relapse was commoner in those who had been ill for shorter periods before operation, but it was very rare among those in the other diagnoses group who had been operated upon within two years of the onset of illness.

The proportion of patients who developed persistent epilepsy after leucotomy was 1·3 per cent. Serious side-effects of leucotomy were recorded in 3·1 per cent of all patients, and these effects were observed more frequently in those over the age of 55 than among younger patients.

ACKNOWLEDGEMENTS

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We should like to record our gratitude to Mr. J. Wrigley, Chief Statistician and Dr. E. R. Bransby, Statistician of this Ministry, who advised on the statistical treatment of the data.

APPENDIX I

Table 1. Total patients analysed by diagnostic group, type of operation and year of operation

	Total	Type of operation		
		Standard	Modified Standard	Other
All diagnoses: Total	10,365	8,778	700	887
Year of operation: 1942	101	101	—	—
1943	190	190	—	—
1944	276	276	—	—
1945	330	330	—	—
1946	585	549	36	—
1947	941	894	45	2
1948	1,159	1,096	57	6
1949	1,211	998	123	90
1950	1,155	934	89	132
1951	1,073	882	54	137
1952	1,177	949	99	129
1953	1,073	840	96	137
1954	1,094	739	101	254
Schizophrenic: Total	6,591	5,855	310	426
Year of operation: 1942–47	1,617	1,561	54	2
1948	763	730	29	4
1949	733	641	34	58
1950	725	616	37	72
1951	665	575	24	66
1952	715	619	40	56
1953	657	571	47	39
1954	716	542	45	129
Affective: Total	2,637	2,083	280	274
Year of operation: 1942–47	619	607	12	—
1948	293	271	21	1
1949	361	268	74	19
1950	318	226	50	42
1951	261	199	23	39
1952	307	226	39	42
1953	257	168	33	56
1954	221	118	28	75
Other: Total	1,137	840	110	187
Year of operation: 1942–47	187	172	15	—
1948	103	95	7	1
1949	117	89	15	13
1950	112	92	2	18
1951	147	108	7	32
1952	155	104	20	31
1953	159	101	16	42
1954	157	79	28	50

Table 2. Total patients in hospital at the time of the survey (including patients who had died in hospital): analysis by clinical condition at time of survey report, diagnostic group, sex and age at operation

	Patients in hospital (or died in hospital)											
	Males						Females					
	Age at operation (years):—						Age at operation (years):—					
	Total	under 25	25–34	35–44	45–54	55 & over	Total	under 25	25–34	35–44	45–54	55 & over
All diagnoses: Total	2,368	261	842	654	360	251	3,229	225	792	933	739	540
Grading:†												
H1 Greatly improved	62	4	16	20	10	12	96	10	21	27	22	16
H2 Social improvement	332	29	128	91	55	29	482	39	114	127	128	74
H3 Social defect	521	50	198	150	86	37	717	50	189	229	154	95
H4 No change	984	144	377	297	127	39	1,341	97	377	406	295	166
H5 Worse	78	12	40	13	7	6	97	5	22	25	20	25
H6 Dead—death A*	119	10	35	24	17	33	144	6	23	27	39	49
H7 „ —death PA*	39	—	8	9	13	9	36	2	4	5	14	11
H8 „ —death NA*	233	12	40	50	45	86	316	16	42	87	67	104
Schizophrenic Total	1,933	245	794	562	257	75	2,392	195	699	775	510	213
Grading:†												
H1 Greatly improved	41	3	14	15	6	3	60	9	18	17	13	3
H2 Social improvement	276	28	120	81	40	7	340	32	90	106	87	25
H3 Social defect	450	47	190	135	67	11	582	45	171	202	119	45
H4 No change	902	139	367	269	108	19	1,087	88	340	347	222	90
H5 Worse	62	11	39	10	2	—	64	4	20	20	13	7
H6 Dead—death A*	70	8	25	17	10	10	64	4	20	16	14	10
H7 „ —death PA*	24	—	7	7	7	3	17	—	3	4	7	3
H8 „ —death NA*	108	9	32	28	17	22	178	13	37	63	35	30
Affective Total	294	4	11	46	76	157	578	5	33	92	164	284
Grading:†												
H1 Greatly improved	11	—	—	2	2	7	24	—	1	6	5	12
H2 Social improvement	38	1	—	4	12	21	84	—	7	9	22	46
H3 Social defect	48	—	1	7	15	25	89	—	5	16	24	44
H4 No change	52	2	4	14	13	19	177	3	17	38	57	62
H5 Worse	7	—	—	2	2	3	27	1	1	2	7	16
H6 Dead—death A*	27	—	3	4	5	15	58	—	1	7	16	34
H7 „ —death PA*	11	—	—	—	5	6	14	1	—	1	4	8
H8 „ —death NA*	100	1	3	13	22	61	105	—	1	13	29	62
Other Total	141	12	37	46	27	19	259	25	60	66	65	43
Grading:†												
H1 Greatly improved	10	1	2	3	2	2	12	1	2	4	4	1
H2 Social improvement	18	—	8	6	3	1	58	7	17	12	19	3
H3 Social defect	23	3	7	8	4	1	46	5	13	11	11	6
H4 No change	30	3	6	14	6	1	77	6	20	21	16	14
H5 Worse	9	1	1	1	3	3	6	—	1	3	—	2
H6 Dead—death A*	22	2	7	3	2	8	22	2	2	4	9	5
H7 „ —death PA*	4	—	1	2	1	—	5	1	1	—	3	—
H8 „ —death NA*	25	2	5	9	6	3	33	3	4	11	3	12

* A—attributed to operation
PA—partly attributed to operation
NA—not attributed to operation

† The rating scales as described in this table and in the following tables 3, 4 and 5 as given in full on pages 8 and 9 of the Report.

Table 3. Total patients discharged from hospital at the time of the survey (including patients who had died outside hospital): analysis by clinical condition at time of survey report, diagnostic group, sex and age at operation

	Patients discharged (or died after discharge)											
	Males						Females					
	Age at operation (years)						Age at operation (years)					
	Total	under 25	25–34	35–44	45–54	55 & over	Total	under 25	25–34	34–44	45–54	55 & over
All diagnoses: Total	1,659	128	513	421	311	286	3,109	184	729	849	702	645
Grading:†												
D1 Total recovery	116	4	31	30	30	21	329	21	62	68	96	82
D2 Social recovery	162	7	45	42	39	29	345	17	86	102	77	63
D3 Greatly improved	114	10	37	34	22	11	216	16	55	57	48	40
D4 Family invalid	42	3	17	9	8	5	105	8	34	27	24	12
D5 Family burden	24	1	12	4	5	2	46	5	12	9	12	8
D6 Dead*	74	6	12	6	7	43	127	7	11	18	29	62
Not followed-up	1,127	97	359	296	200	175	1,941	110	469	568	416	378
Schizophrenic: Total	880	116	411	239	92	22	1,386	141	524	434	197	90
Grading:†												
D1 Total recovery	52	4	24	16	8	—	102	15	35	18	24	10
D2 Social recovery	89	7	38	30	12	2	148	14	55	50	21	8
D3 Greatly improved	76	8	31	26	10	1	121	11	46	34	21	9
D4 Family invalid	23	3	15	4	1	—	62	5	28	18	10	1
D5 Family burden	15	1	11	2	1	—	25	4	9	5	6	1
D6 Dead*	23	6	8	3	2	4	29	5	6	9	3	6
Not followed-up	602	87	284	158	58	15	899	87	345	300	112	55
Affective: Total	500	—	20	96	151	233	1,265	10	96	266	405	488
Grading:†												
D1 Total recovery	50	—	4	10	16	20	186	—	18	37	66	65
D2 Social recovery	49	—	—	8	20	21	144	2	13	38	42	49
D3 Greatly improved	24	—	1	5	10	8	69	1	4	16	20	28
D4 Family invalid	12	—	1	2	4	5	28	—	5	6	8	9
D5 Family burden	7	—	—	2	3	2	16	—	2	2	5	7
D6 Dead*	44	—	—	3	3	38	78	—	1	5	23	49
Not followed-up	314	—	14	66	95	139	744	7	53	162	241	281
Other: Total	279	12	82	86	68	31	458	33	109	149	100	67
Grading:†												
D1 Total recovery	14	—	3	4	6	1	41	6	9	13	6	7
D2 Social recovery	24	—	7	4	7	6	53	1	18	14	14	6
D3 Greatly improved	14	2	5	3	2	2	26	4	5	7	7	3
D4 Family invalid	7	—	1	3	3	—	15	3	1	3	6	2
D5 Family burden	2	—	1	—	1	—	5	1	1	2	1	—
D6 Dead*	7	—	4	—	2	1	20	2	4	4	3	7
Not followed-up	211	10	61	72	47	21	298	16	71	106	63	42

* All not attributed to the operation except 5 partly attributed and 7 for which no information was available.

† See footnote † to table 2

Table 4. Total patients in hospital at the time of the survey (including patients who had died in hospital): analysis by clinical condition at time of survey report, diagnostic group and duration of illness before operation

	Patients in hospital (or died in hospital)						
		Duration of illness before operation (years):—					
	Total	Under 2	2–6	7–11	12–16	17 and over	Not followed up
All diagnoses: Total	5,597	567	2,189	1,178	639	747	277
Grading:†							
H1 Greatly improved	158	18	57	29	11	34	9
H2 Social improvement	814	82	337	142	100	114	39
H3 Social defect	1,238	108	470	298	140	181	41
H4 No change	2,325	213	928	509	280	277	118
H5 Worse	175	25	72	30	10	16	22
H6 Dead—Death A*	263	44	101	43	25	39	11
H7 ,, —Death PA*	75	5	25	16	10	15	4
H8 ,, —Death NA*	549	72	199	111	63	71	33
Schizophrenic: Total	4,325	405	1,718	945	505	550	202
Grading:†							
H1 Greatly improved	101	14	40	15	7	20	5
H2 Social improvement	616	60	263	109	79	83	22
H3 Social defect	1,032	88	395	261	118	142	28
H4 No change	1,989	180	804	436	240	230	99
H5 Worse	126	17	51	24	8	8	18
H6 Dead—Death A*	134	16	50	27	14	21	6
H7 ,, —Death PA*	41	2	14	9	5	9	2
H8 ,, —Death NA*	286	28	101	64	34	37	22
Affective: Total	872	127	347	156	90	121	31
Grading:†							
H1 Greatly improved	35	3	11	8	2	9	2
H2 Social improvement	122	15	50	18	11	23	5
H3 Social defect	137	18	50	24	15	24	6
H4 No change	229	19	88	54	30	28	10
H5 Worse	34	6	18	3	2	5	—
H6 Dead—Death A*	85	25	38	10	6	6	—
H7 ,, —Death PA*	25	2	10	6	4	2	1
H8 ,, —Death NA*	205	39	82	33	20	24	7
Other: Total	400	35	124	77	44	76	44
Grading:†							
H1 Greatly improved	22	1	6	6	2	5	2
H2 Social improvement	76	7	24	15	10	8	12
H3 Social defect	69	2	25	13	7	15	7
H4 No change	107	14	36	19	10	19	9
H5 Worse	15	2	3	3	—	3	4
H6 Dead—Death A*	44	3	13	6	5	12	5
H7 ,, —Death PA*	9	1	1	1	1	4	1
H8 ,, —Death NA*	58	5	16	14	9	10	4

* A = Attributed to operation; PA = Partly attributed to operation; NA = Not attributed to operation.

† See footnote † to table 2

Table 5. Total patients discharged from hospital at the time of the survey (including patients who had died outside hospital): analysis by clinical condition at time of survey report, diagnostic group and duration of illness before operation

	Patients discharged (or died after discharge)						
	Total	Duration of illness before operation (years):—					
		Under 2	2–6	7–11	12–16	17 and over	Not known
All diagnoses: Total	4,768	857	2,129	736	377	436	233
Grading:†							
D1 Total recovery.. ..	445	121	180	66	37	35	6
D2 Social recovery ..	507	80	251	71	35	48	22
D3 Greatly improved ..	330	65	156	49	23	21	16
D4 Family invalid.. ..	147	16	70	24	9	18	10
D5 Family burden ..	70	24	23	10	6	7	—
D6 Dead*	201	49	88	22	8	22	12
Not followed-up	3,068	502	1,361	494	259	285	167
Schizophrenic: Total	2,266	358	1,097	409	178	120	104
Grading:†							
D1 Total recovery.. ..	154	39	73	26	10	5	1
D2 Social recovery ..	237	34	130	42	13	7	11
D3 Greatly improved ..	197	41	93	30	13	10	10
D4 Family invalid.. ..	85	6	41	18	5	8	7
D5 Family burden ..	40	12	15	7	3	3	—
D6 Dead*	52	7	21	11	5	5	3
Not followed-up	1,501	219	724	275	129	82	72
Affective: Total..	1,765	411	741	206	130	207	70
Grading:†							
D1 Total recovery.. ..	236	73	88	29	22	23	1
D2 Social recovery ..	193	41	88	16	14	29	5
D3 Greatly improved ..	93	19	46	12	7	7	2
D4 Family invalid.. ..	40	10	19	2	3	4	2
D5 Family burden ..	23	11	6	2	2	2	—
D6 Dead*	122	38	57	8	2	12	5
Not followed-up	1,058	219	437	137	80	130	55
Other: Total	737	88	291	121	69	109	59
Grading:†							
D1 Total recovery.. ..	55	9	19	11	5	7	4
D2 Social recovery ..	77	5	33	13	8	12	6
D3 Greatly improved ..	40	5	17	7	3	4	4
D4 Family invalid.. ..	22	—	10	4	1	6	1
D5 Family burden ..	7	1	2	1	1	2	—
D6 Dead*	27	4	10	3	1	5	4
Not followed-up	509	64	200	82	50	73	40

* All not attributed to the operation, except 5 partly attributed and 7 for which no information was available.

† See footnote † to table 2

Table 6. Total patients in hospital at the time of the survey (other than patients who had died in hospital): analysis by incidence of relapse, diagnostic group and age at operation*

	Patients in hospital (or died in hospital)					
		Age at operation (years)				
	Total	Under 25	25–34	35–44	45–54	55 and over
All diagnoses: Total	4,710	440	1,482	1,385	904	499
Relapsed before discharge	426	33	138	138	78	39
Relapsed after discharge and re-admitted ..	785	139	290	167	112	77
No relapse	3,499	268	1,054	1,080	714	383
Schizophrenic: Total	3,864	406	1,369	1,202	677	210
Relapsed before discharge	362	32	126	127	57	20
Relapsed after discharge and re-admitted ..	596	127	267	132	60	10
No relapse	2,906	247	976	943	560	180
Affective: Total	557	7	36	100	159	255
Relapsed before discharge	44	1	4	7	14	18
Relapsed after discharge and re-admitted ..	127	3	11	14	39	60
No relapse	386	3	21	79	106	177
Other: Total	289	27	77	83	68	34
Relapsed before discharge	20	—	8	4	7	1
Relapsed after discharge and re-admitted ..	62	9	12	21	13	7
No relapse	207	18	57	58	48	26

* See Table 4 for reconciliation of totals: in the all diagnoses section the total of 4,710 is obtained by subtracting 887 (= 263 + 75 + 549) deaths from the total of 5,597.

Table 7. Total patients discharged from hospital at the time of the survey and followed-up (other than patients who had died after discharge): analysis by incidence of relapse, diagnostic group and age at operation*

	Patients discharged (or died after discharge)					
	Total	Age at operation (years)				
		Under 25	25–34	35–44	45–54	55 and over
All diagnoses: Total	1,499	92	391	382	361	273
Discharged after re-admission for relapse	288	35	92	81	50	30
No relapse	1,211	57	299	301	311	243
Schizophrenic: Total	713	72	292	203	114	32
Discharged after re-admission for relapse	162	29	72	41	15	5
No relapse	551	43	220	162	99	27
Affective: Total	585	3	48	126	194	214
Discharged after re-admission for relapse	84	1	7	26	27	23
No relapse	501	2	41	100	167	191
Other: Total	201	17	51	53	53	27
Discharged after re-admission for relapse	42	5	13	14	8	2
No relapse	159	12	38	39	45	25

* See Table 5 for reconciliation of totals: in the all diagnoses section the total of 1,499 is obtained by subtracting 201 deaths and 3,068 not followed-up cases from the total of 4,768.

Table 8. Total patients in hospital, discharged or dead at the time of the survey: estimated distributions by clinical condition at time of survey report of patients analysed by diagnosis, sex and age at operation*

	Males						Females					
		Age at operation (years):						Age at operation (years):				
	Total	Under 25	25–34	35–44	45–54	55 and over	Total	Under 25	25–34	35–44	45–54	55 and over
All Diagnoses												
Number	3,577	353	1,273	1,006	607	338	5,707	376	1,449	1,639	1,304	939
Per cent by clinical category†:												
D1	10	5	8	10	14	15	15	13	12	12	18	21
D2	14	8	12	14	18	22	17	12	17	19	15	17
D3 and H1 ..	12	13	11	13	11	12	12	13	12	12	11	12
D4 and H2 ..	13	12	14	13	13	12	13	16	15	13	14	11
D5 and H3 ..	17	15	19	16	17	12	15	16	15	16	14	12
H4	28	41	29	30	21	12	23	26	26	25	23	18
H5	2	3	3	1	1	2	2	1	1	1	1	3
H6	3	3	3	2	3	10	2	2	2	2	3	5
H7	1	—	1	1	2	3	1	1	—	—	1	1
Schizophrenic												
Number	2,627	328	1,147	764	327	61	3,519	310	1,169	1,117	665	258
Per cent by clinical category†:												
D1	6	5	7	6	7	—	8	13	9	5	8	10
D2	11	9	11	12	10	8	12	12	13	15	7	8
D3 and H1 ..	11	11	10	12	10	10	12	12	13	11	9	10
D4 and H2 ..	13	12	15.	12	13	12	15	15	15	15	17	10
D5 and H3 ..	19	16	19	19	21	18	18	18	17	20	20	19
H4	34	42	32	35	33	31	31	28	29	31	34	35
H5	2	3	3	1	1	—	2	1	2	2	2	3
H6 and H7 ..	4	2	3	3	5	21	2	1	2	1	3	5
Affective												
Number	582	3	28	119	197	235	1,557	15	126	332	485	599
Per cent by clinical category†:												
D1	24	—	50	27	23	21	29	—	32	29	34	26
D2	23	—	—	22	27	22	23	46	23	29	21	20
D3 and H1 ..	13	—	11	15	14	12	12	20	8	14	11	13
D4 and H2 ..	12	33	11	8	11	14	10	—	14	7	9	11
D5 and H3 ..	11	—	3	11	12	13	8	—	8	6	8	10
H4	9	67	14	12	6	8	11	20	13	12	12	10
H5	1	—	—	2	1	1	2	7	1	1	1	3
H6 and H7 ..	7	—	11	3	6	9	5	7	1	2	4	7
Other												
Number	368	22	98	123	83	42	631	51	154	190	154	82
Per cent by clinical category†:												
D1	16	—	12	20	24	8	19	21	17	24	10	26
D2	25	—	28	20	28	43	25	4	34	26	25	21
D3 and H1 ..	19	59	22	17	10	16	14	18	10	15	15	12
D4 and H2 ..	14	—	12	20	16	2	15	25	13	12	23	9
D5 and H3 ..	8	14	11	7	8	2	10	14	10	9	9	7
H4	8	14	6	11	7	2	12	12	13	11	10	17
H5	3	4	1	1	4	8	1	—	1	1	—	2
H6 and H7 ..	7	9	8	4	3	19	4	6	2	2	8	6

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* Including not followed-up discharges but excluding deaths not attributed to the operation. See tables 2 and 3 for figures from which the totals given here are derived: for males in the all diagnoses section the total of 3,577 is obtained as the sum of the totals given in tables 2 and 3 (viz. 4,027 = 2,368 + 1,659) less 233 deaths in hospital not attributed to the operation and less 217 deaths outside hospital. The latter figure is calculated from table 3 to include an estimated proportion of not followed-up cases (see B of Appendix II).

† See tables 2 and 3 for key to clinical categories.

Table 9. Total patients in hospital, discharged or dead at the time of the survey: estimated distributions, by clinical condition at time of survey report, of patients analysed by diagnosis and duration of illness before operation*

	Total	Duration of illness before operation (years)					
		Under 2	2–6	7–11	12–16	17 and over	Not known
All diagnoses							
Number	9,284	1,242	3,893	1,737	926	1,051	435
Per cent by clinical category†:							
D1	13	24	12	12	12	10	5
D2	16	16	18	12	13	13	18
D3 and H1	12	15	13	10	9	9	15
D4 and H2	13	9	14	12	14	16	17
D5 and H3	15	13	14	19	17	19	9
H4	25	17	24	29	30	26	27
H5	2	2	2	2	1	2	5
H6	3	4	2	3	3	4	3
H7	1	—	1	1	1	1	1
Schizophrenic							
Number	6,146	716	2,651	1,256	631	616	276
Per cent by clinical category†:							
D1	7	14	8	6	6	3	1
D2	12	13	14	10	8	4	13
D3 and H1	11	17	12	9	9	8	14
D4 and H2	14	10	14	13	15	18	16
D5 and H3	19	17	17	22	20	25	10
H4	32	25	30	35	38	37	36
H5	2	2	2	2	1	1	7
H6 and H7	3	2	3	3	3	4	3
Affective							
Number	2,139	421	872	306	195	273	72
Per cent by clinical category†:							
D1	28	38	25	28	29	23	7
D2	23	21	25	16	19	29	32
D3 and H1	13	11	14	14	10	10	17
D4 and H2	10	8	11	8	10	12	21
D5 and H3	9	10	8	10	10	11	8
H4	11	5	10	18	16	10	14
H5	1	1	2	1	1	2	—
H6 and H7	5	6	5	5	5	3	1
Other							
Number	999	105	370	175	100	162	87
Per cent by clinical category†:							
D1	18	31	16	19	18	13	14
D2	25	17	29	23	29	24	22
D3 and H1	16	20	17	16	12	11	16
D4 and H2	15	7	15	16	14	16	18
D5 and H3	9	6	8	9	11	13	8
H4	11	13	10	11	10	12	10
H5	1	2	1	2	—	2	5
H6 and H7	5	4	4	4	6	9	7

* Including not followed-up discharges but excluding deaths not attributed to the operation. See Tables 4 and 5 for figures from which the totals given here are derived: for the all diagnoses section the total of 9,284 is obtained as the total of all patients in the survey (5,597 + 4,768 = 10,365) less 549 deaths in hospital not attributed to the operation and less 563 deaths outside hospital. The latter figure is calculated from Table 5 to include an estimated proportion of not followed-up cases. (See B of Appendix II.)

† See Tables 2 and 3 for key to clinical categories.

APPENDIX II

Part A. Note of the varying length of interval between the date of the operation and the date at which the survey report was made.

The survey covered leucotomy operations spread over the thirteen years 1942–54 while the clinical assessments were in respect of the patient's condition at the time when the survey record was completed in 1956 or 1957.

This made it necessary to assess whether the survey records for patients whose operations took place early in the survey period could justifiably be aggregated with those which took place later.

An analysis of the clinical condition of patients (hospital and discharge cases aggregated, including estimates for not followed-up discharges), by interval between the operation and making the survey report, showed little association between these two factors. The only considerable difference was in the percentage of patients with clinical condition reported unchanged (category H.4). This percentage rose from 20 for patients reported on within four years of the operation to 30 for those reported on after at least ten years. This clinical category included a quarter of all patients covered in the survey. The figures for the aggregate of the top three clinical categories in the grading scale, which broadly cover the cases in which some improvement is recorded, showed a rather smaller gradient from 42 per cent for patients reported on within four years, to 36 per cent for the cases reported on after at least ten years. The age and sex distribution of patients in the survey were very similar for each of these groups by interval between operation and making the survey report. The same was true of distribution by duration of illness before the operation.

It was felt that the differences between one interval group and another are sufficiently small to justify the disregard of this factor in interpreting the survey data.

Part B. Comparison between patients discharged and followed-up and those discharged and not followed-up.

The survey covered 4,768 patients who were out of hospital at the time of the survey or had died after discharge from hospital subsequent to a leucotomy operation. Only 1,700 of these cases had been followed-up to provide the clinical grading at the time of the survey and to provide information on the occurrence of relapses in the period since the leucotomy operation.

Since the clinical grading of the patient was by no means independent of the probability of his discharge from hospital, separate assessments of grading for the "in hospital" group and for the "discharged" group would have been of little value; nor, in bringing these two groups together, would it have been justifiable to aggregate the hospital and followed-up (F.U.) discharge cases leaving out of account the not followed-up (N.F.U.) discharge cases.

In accordance with normal statistical practice in dealing with non-response, comparisons were made between the F.U. and the N.F.U. discharge cases with the object of deciding whether it would be justifiable to assume that the F.U. cases could be taken as representative of the N.F.U. cases in presenting the clinical findings. The comparisons were made for all the main survey factors, age, sex, duration of illness before operation, diagnosis, interval between operation and survey report, type of operation, and clinical grading, either singly or, in some cases, in combination.

Variations in proportions of cases followed-up: Overall, 36 per cent of discharged patients were followed-up. The proportion was a little higher for females than for males, and higher for older than for younger patients. It was also a little higher for patients who had their leucotomy operation within two years of the onset of their illness than for other patients and, as would be expected, higher for those who had been operated on closer in time to the date when their survey record was compiled than for those whose operations had been a long time previously. Differences were found also between the diagnostic groups, the proportion followed-up being highest for the affective group and lowest for the "other" diagnosis group; and patients who had the non-standard types of operation were followed-up in slightly greater relative numbers than those given the standard treatment. All these differences, though understandable and real, were comparatively small, the percentages of F.U. cases in general ranging between 30 and 36 in the case of males and between 33 and 41 in the case of females. Moreover the classes of patient which were exceptional in this respect accounted for relatively small numbers of patients: the 65 years and over age group with 42 and 50 per cent F.U. for males and females respectively accounted for only 110 F.U. patients; the ten years and over interval since operation group with 25 per cent F.U. accounted for 156 F.U. patients; and the non-standard operation sub-division of the "other" diagnoses group with 25 per cent accounted for 54 F.U. patients.

Variations in clinical grading distributions: These were considerable as between the diagnostic groups, and as between the patients in each diagnostic group who had the standard and the non-standard leucotomy treatments respectively.

Differences by age and sex, by duration of illness before operation and by interval since operation, were comparatively small except for the high incidence of death in the older age groups which is to be expected.

The validity of the assumption under examination depends in part on the interaction between the variations in the proportions of F.U. cases for different kinds of patient and the variations in the distributions by clinical grading. This interaction can conveniently be examined by forming estimated clinical grading percentages standardized for various factors in turn in order to eliminate the effect of differences in the proportions of F.U. cases in classifications by each factor: e.g. the estimated percentage totally recovered standardized for age would be calculated by weighting the percentage for each age group among F.U. cases by the total of F.U. + N.F.U. cases. Percentages derived in this way have been formed for each of the six clinical gradings (including death) in standardizations by age, duration of illness before operation, and diagnosis respectively; and for the percentage totally recovered for each sex separately in standardizations by age, diagnosis, type of operation, and interval since operation respectively. In none of these cases did the standardized percentage differ by as much as one from the crude rate derived from the F.U. data only.

The factors used in the standardizations described by no means exhaust the possibilities of differences, both because they have been used separately and not in combination with one another, and because they are not the only factors which might be important. The insignificance of the differences between all pairs of standardized and unstandardized percentages which have been calculated does, however, give some ground for thinking that the same would be true of other such standardizations.

As a result of this examination, and in the light of considerations external to the survey which are referred to in the report, it was decided that the clinical data of the survey could most usefully be presented by bringing the N.F.U. discharge cases into the estimates on the assumption that they were similar to the F.U. cases for each group of patients in a diagnosis by sex by age classification and for each group in a diagnosis by duration of illness before operation classification. It was obviously impracticable to bring all possible factors into such a scheme of analysis: diagnosis was taken into account because of the magnitude of the differences in the clinical grading distributions; sex, age and duration of illness were brought in because they are fundamental factors of particular interest to those concerned with the results of the survey; type of operation was omitted in spite of the comparatively large difference between the grading distributions for the standard and non-standard types, because the numbers of non-standard operations were small.

Exactly corresponding assumptions have been made in presenting the survey evidence on incidence of relapse.

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